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| **Source** | **Samsung Electronics** |
| **Status** | **Input contribution** |
| **Title** | **[V-PCC][CE2.20 software] Reference software for constrained occupancy map trimming** |
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# Abstract

Constrained trimming of occupancy map based on a ternary occupancy map was proposed in the 126th MPEG meeting [1]. As mandated in the Core Experiment 2.20 [2], all the occupancy map filtering techniques in CE2.20 are evaluated in combination with the constrained occupancy map trimming which was introduced in m47593. The reference software for contribution m47593 was released and integrated by the CE2.20 proponents in their occupancy map filtering techniques. This documents briefly describes the reference software for m47593. A patch to be applied on top of tmc2v6.0 for the reference software for this method is accompanying this submission.

# Introduction

V-PCC allows to sub-sample the occupancy map by a factor equal to the occupancy precision before encoding. In the decoder, the occupancy map is up-sampled back to original resolution. Prior to sub-sampling the original occupancy map, partially filled blocks of 4x4 points (for occupancy precision = 4) are filled with 1. As a results, after up-sampling the occupancy map at the decoder, all the points in the block of 4x4 points will be used to reconstruct the point cloud. These extra points generated due to the limited occupancy precision have an adverse impact on the reconstructed point cloud and often result in visual artifacts and losses in objective scores.

At the last meeting, the CE2.20 proponents have proposed different techniques to remove invalid points from the occupancy map at the decoder. However, these techniques often remove some of the valid points. That would degrade the visual quality of the reconstructed point cloud. Contribution m47593 introduced a method for constrained occupancy map trimming to avoid removing valid points.

# Reference software for constrained occupancy map trimming

In the V-PCC Test Model version 6.0, the original full-resolution occupancy map is compared with the filtered occupancy map. If it is detected that a valid point in a block of 4x4 points (for the occupancy precision = 4, for other occupancy precision values, 4 will be replaced with occupancy precision) is discarded, an occupancy value of 2 will be assigned to that block and as a result no trimming will be allowed on that block at the decoder.

In the implementation of constrained occupancy map trimming in the V-PCC Test Model, the function generateTernaryOccupancyMap( ) is defined wherein the original full-resolution occupancy map is compared with the filtered occupancy map. If a valid point is discarded from a block, an occupancy value of 2 is assigned to that block in a ternary occupancy map. Otherwise, no change will be made to the filtered occupancy map. The output of generateTernaryOccupancyMap( ) will be the ternary occupancy map. This function is called in generateOccupancyMapVideo( ) at the encoder. At the decoder, the ternary occupancy map will be used to do constrained occupancy map trimming by which a block will not be allowed to be trimmed if its corresponding occupancy value in the ternary occupancy map indicates so. Figures 1 and 2 shows flow charts for constrained occupancy map trimming at the encoder and the decoder.

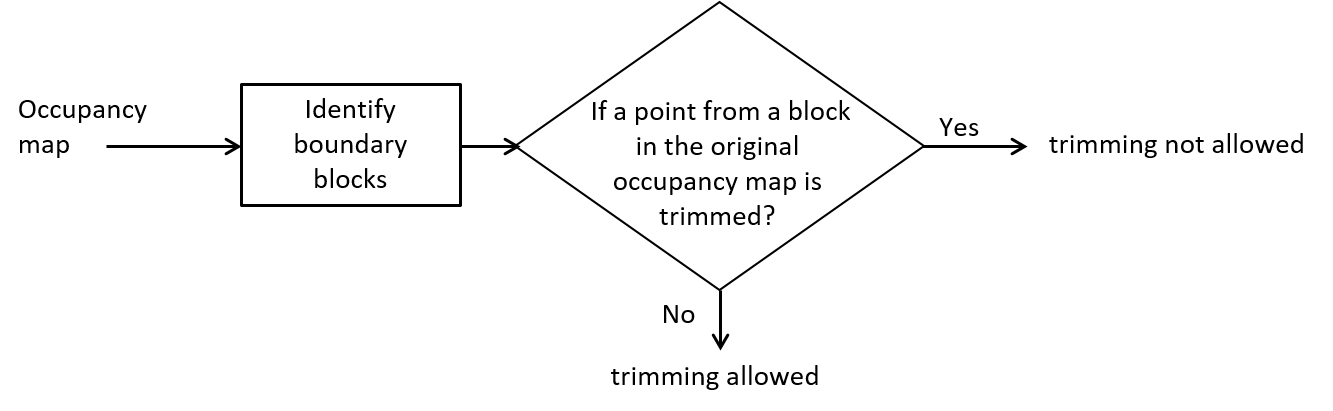


Figure 1. Flow chart for the encoder for constrained occupancy map trimming.

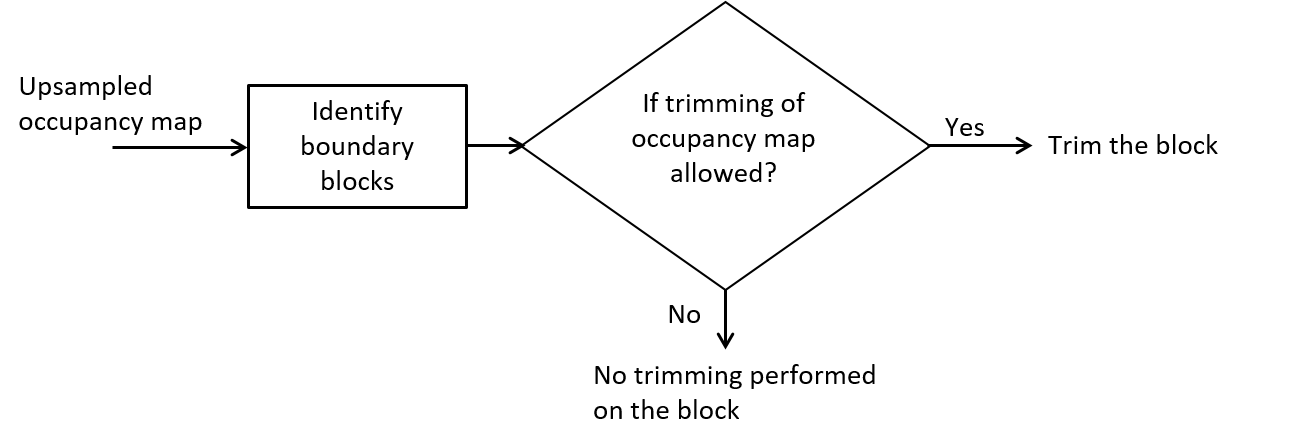


Figure 2. Flow chart for the decoder for constrained occupancy map trimming.

The flag occupancyMapTrimmingFlag is signaled to the decoder if occupancy filtering is performed. Another flag constrainedOMapTrimmingFlag will be used to enable constrained occupancy map trimming. If occupancyMapTrimmingFlag is disabled, the flag constrainedOMapTrimmingFlag will be forced to be disabled.

# Conclusion

The reference software for constrained occupancy map trimming was released and combined with occupancy map filtering techniques by the CE2.20 proponents. A brief description of the reference software for occupancy map trimming was provided in this document. The reference software for this method is accompanying this submission.

It is recommended that the proposed method be integrated into the V-PCC Test Model.

# References

1. “[VPCC][New proposal] On occupancy map trimming,” ISO/IEC JTC1/SC29 WG11 input document m47593, Geneva, Switzerland, March 2019.
2. “PCC CE 2.20 on occupancy map 2D filters,” ISO/IEC JTC1/SC29 WG11 output document N18491, Geneva, Switzerland, March 2019.